

Mountain NRQZ for 533 MHz and 772 MHz. The difference in field strengths for the two frequencies is due to the fact that the amplitude of the diffracted wave decreases with increasing frequency. From this figure it is seen that for the Table Mountain NRQZ, the predicted field strengths are about 0.1 mV/m to 0.2 mV/m. These field strengths are well within the FCC Table Mountain NRQZ regulatory limits. Thus, a transmitter can be located at Squaw Mountain without violating the FCC regulatory limits or jeopardizing the research efforts at the Table Mountain NRQZ.

Even though the DTV frequency allocation is in the 400 MHz to 700 MHz band, there is the possibility that broadcasters could decide to broadcast DTV signals at their currently assigned NTSC frequencies [29]. This means that some DTV transmissions could be below 400 MHz. Since propagation loss can decrease with frequency, it is important to calculate field strengths that would result from broadcasting at the lower NTSC frequencies. Field strengths were calculated at 54 MHz (the lowest NTSC frequency) at the Table Mountain NRQZ and at the DOC Laboratories with the transmitter on Eldorado Mountain and Squaw Mountain. These results are shown in figures 67, 68, and 71. In figure 67, it is seen that the 54 MHz results are very similar to the 533 MHz and 772 MHz results for a transmitter on Eldorado Mountain. The similarity in the results for all three frequencies is due to the fact that the Table Mountain NRQZ is LOS from Eldorado Mountain. For a transmitter on Eldorado Mountain, the E-field strengths for all three frequencies exceed the FCC limit. In figure 71 (transmitter on Squaw Mountain), it is seen that the 54 MHz field strengths are somewhat larger than those at the other two frequencies (due to diffraction effects). As seen in table 2, the FCC NRQZ limit is smaller for 54 MHz. The predicted E-field strengths for a transmitter on Squaw Mountain at 54 MHz do exceed this FCC limit.

Here again, the data presented in this section are for an EIRP of 1 MW. Since some DTV broadcasters have received allocations to transmit at 1.64 MW (see table 1), predicted field strengths for 1.64 MW are needed. The E-field presented here can be converted to a 1.64 MW EIRP level by multiplying the results in all the figures by a factor of 1.3, resulting in even higher E-field strengths than those presented here. This would result in even greater E-field strengths in the Boulder–Denver area, and would cause even greater interference at both of the DOC facilities due to a transmitter located on the Eldorado Mountain site.

## **6. DTV E-FIELD STRENGTH REQUIREMENT**

Measured and modeled results to this point have assumed either a 2 m (6.6 ft) or 2.95 m (9.68 ft) receiving antenna height. Designs of tower locations and power requirements are based on the FCC's 9.14 m (30 ft) receiver antenna height assumption. For acceptable DTV reception, the FCC has recommended a minimum E-field strength of 41 dB $\mu$ V/m (0.11 mV/m) at a 9.14 m (30 ft) receiver antenna height [1]. The ITM prediction model can be used to determine at what locations in the Boulder–Denver area the 41 dB $\mu$ V/m field strengths for a 9.14 m (30 ft) receiving antenna height can be achieved for given tower locations.

Figures 72 and 73 show the contour plot of the predicted field strengths for the Boulder–Denver area for a transmitter located at Eldorado Mountain for frequencies of 533 MHz and 772 MHz, respectively. These results were calculated for a transmitter antenna height of 116 m (379 ft), a receiver height of 9.14 m (30 ft), and 1 MW EIRP. Figures 74 and 75 show the contour plots of the predicted field strengths for the Boulder–Denver area for a transmitter located on Squaw Mountain for 533 MHz and 772 MHz, respectively. These results were calculated for a transmitter antenna height of 60.96 m (200 ft), a receiver height of 9.14 m (30 ft), and 1 MW EIRP.

One might ask how transmitter locations would affect DTV reception. Of interest here are the locations where the 41 dB $\mu$ V/m (0.11 mV/m) FCC field strength is exceeded. If 41 dB $\mu$ V/m is exceeded, DTV reception is possible according to the FCC’s assumptions. The data shown in figures 72 through 75 are re-plotted to illustrate where the FCC’s minimum field strength is met or exceeded. These new results are shown in figures 76 through 79. In figures 76 through 79, the white areas in the plot correspond to where the FCC’s minimum field strength is exceeded. The blue shaded areas indicate areas with field strengths that are below the FCC’s minimum field strength recommendation for DTV reception. These blue areas indicate that DTV may not be received in these areas, as indicated by the FCC’s recommendation. Note that as far as the FCC’s 41 dB $\mu$ V/m (0.11 mV/m) recommendation is concerned, it is seen in figures 76 through 79 that Squaw Mountain covers basically the same area as a transmitter on Eldorado Mountain, for the purposes of DTV reception with a 9.14 m (30 ft) height fixed receiving antenna. Based on the results in the previous section, while the Squaw Mountain site covers the same area as the Eldorado Mountain site, the Squaw Mountain site does not violate the regulatory field strength limits protecting the Table Mountain NRQZ. The Squaw Mountain site would also provide additional protection to the DOC Laboratories. Note that if a 1.64 MW EIRP is used, the 41dB $\mu$ V/m recommendation limits would extend the DTV coverage area.

## **7. ANTENNA PATTERN EFFECTS**

All the predicted E-field strengths presented in this report were obtained with the assumption that the transmitting antenna was an omnidirectional antenna. The measurement data presented here were collected with antennas with moderate antenna patterns, i.e., a 1.9 dBi omni-azimuthal directional antenna on the Eldorado Mountain site and a 6.5 dBi log-periodic antenna on the Squaw Mountain site. The actual antennas that will be used for the proposed tower will have some type of antenna pattern associated with them. The ITM propagation model presented here has a capability of using any transmitter antenna pattern in the prediction. Unfortunately, at this time we do not have information on the antenna patterns. At a later date, when and if such antenna patterns are available, new predicted E-field strengths will be calculated.

With this noted, the results in this report can still be used once the actual antenna patterns are known, as explained in the following. When LOS propagation conditions are present, the simple free-space calculation given in equation (2) can be used to determine the E-field strengths without the need to resort to the ITM prediction model. LOS situations